MSE 4755: Packaging Substrate Fabrication

Credit hours and contact hours: 3-0-0-3

Instructor: Rao Tummala

Textbook: No textbook used. Instructor notes used.

Specific course information

Catalog description: This course provides students with hands-on instruction in basic SOP concepts and techniques, including interconnect design, substrate material selection and properties, photodielectric deposition, via formation and photolithography, copper metallization, and finally, substrate testing. Laboratory instructions are augmented by an interactive multimedia educational presentation that makes the course work material remotely accessible via the internet.

Prerequisites: MATH 2401- Calculus III and MATH 2403 - Differential Equations and CHEM 1211K - Chemical Principles I and PHYS 2212 - Introduction to Physics II

Course: Selected Elective

Specific goals for the course

Outcomes of instruction:

1. Understand why and how devices and systems are packaged
2. Understand multilayer organic Substrate Design and physical Layout
3. Understand the role polymer materials as dielectrics and copper as conductors
4. Understand how Polymers are deposited and cured
5. Understand Laser and photo processes for microvia formation in polymer dielectrics
6. Understand lithography process methods
7. Understand microvia copper metallization by electroplating technologies
8. Understand how to fabricate multi-layer wiring and build-up substrate technology
9. Understand the role of passive components (capacitors, inductors and resistors) in circuits
10. Understand inspection, metrology and substrate testing
11. Learn to operate tools and handle chemicals safely

Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Topics covered:

1. Introduction to Packaging (including PRC SLIM)
2. Lab Safety
3. Interconnect Design
4. Polymer Deposition
5. Via Formation
6. Metallization
7. Substrate Testing

Correlation between Outcomes of Instruction and Student Outcomes:

Outcomes of Instruction	Student Outcomes						
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. Understand why and how devices and systems are packaged	X	X				X	
2. Understand multilayer organic Substrate Design and physical Layout	X	X				X	
3. Understand the role polymer materials as dielectrics and copper as conductors	X	X				X	
4. Understand how Polymers are deposited and cured	X	X				X	
5. Understand Laser and photo processes for microvia formation in polymer dielectrics	X	X				X	
6. Understand lithography process methods	X	X				X	
7. Understand microvia copper metallization by electroplating technologies	X	X				X	
8. Understand how to fabricate multi-layer wiring and build-up substrate technology	X	X				X	
9. Understand the role of passives (capacitors, inductors and resistors) in forming circuits	X	X				X	
10. Understand inspection, metrology and substrate testing	X	X				X	
11. Learn to operate tools and handle chemicals safely	X	X				X	

School of Materials Science and Engineering Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(3) An ability to communicate effectively with a range of audiences.
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.